NAVSEA KEYPORT
Undersea Warfare Center Division

ENHANCING SEA WARRIOR PERFORMANCE

Remote Collaboration: The Next Step in Advanced Learning Delivery

"An example of the human as part of the system"

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PRESENTATION OUTLINE

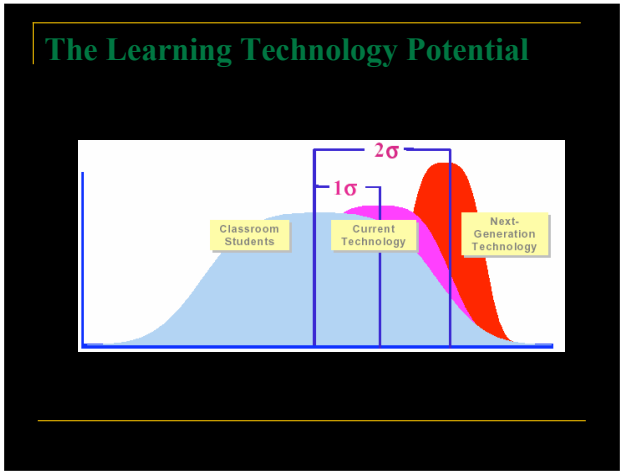
- The Challenge
- Executive Review of Navy Training
- Current Navy Challenges
- Remote Knowledge Delivery Concept
- Remote Technical Assistance Support System (RTASS)
- Potential Use in a Learning Environment
- Conclusion

Photo # NH 78806-KN Recruiting Poster by Ruttan

Rethinking the Foundation of Traditional Operator & Maintenance Training

THE CHALLENGE

- Learning technology potential
  - Knowledge retained best while doing
  - Motivation is a critical learning factor
  - Relevance of material
  - Hands-on practice and interaction
  - Knowing why increases motivation
  - Information internalized best in a collaborative environment
  - Transference of newly acquired skill to actual performance of the job



Tailored, Individualized instruction to learner's specific needs and abilities

EXECUTIVE REVIEW OF NAVY TRAINING

- The Science of Learning
  - Tailored instruction more effective than group-paced
  - Building confidence & self awareness aids learning process
  - Measurement & feedback paramount to sustaining effective learning
- Adult Learning Theory Basis for Remote Delivery
  - Constructivist learning environment designers try to model natural setting - Facilitate learning best by doing
  - Learning settings need to be as close to the work setting as possible
  - Observing experts solving problems in realistic context
- Navy's emerging Revolution in Training
  - Focuses need for human performance technology innovations
  - Performance support environments emphasize learning while doing in a real work environment

Source: ERNT – July 2001

CURRENT NAVY CHALLENGES

- Navy faces complex environment
  - Fewer resources and increasing requirements
    - More missions
    - More sophisticated technology
    - Ships with lower manning
    - Greater number of technical job skills required per sailor
  - Ships crew insufficient to effect repairs
    - Escalated external contact to obtain assistance
    - If remote contact ineffective, embarked tech assist required
    - Considerable costs incurred
- Today's challenge for Program Managers
  - Provide systems that incorporate tomorrow's technology
  - Enhance performance of human operators and effectiveness of total system
  - Human systems integration (HSI) to transform military system effectiveness
  - Ships systems are becoming more complex – maintenance costs rising
  - High cost of training system maintainers must be weighed against the cost of embarked tech assists

REMOTE KNOWLEDGE DELIVERY CONCEPT

- Addressing challenges with remote performance support tools - RTASS
- Provide the sailor with an “over the shoulder” expert presence
- Enable them to collaborate on maintenance tasks and repairs
- The Goal:
  - Knowledge transfer
  - Improve sailor self-sufficiency

Providing a high fidelity collaborative experience would increase sailor’s knowledge base through “on-the-job learning”

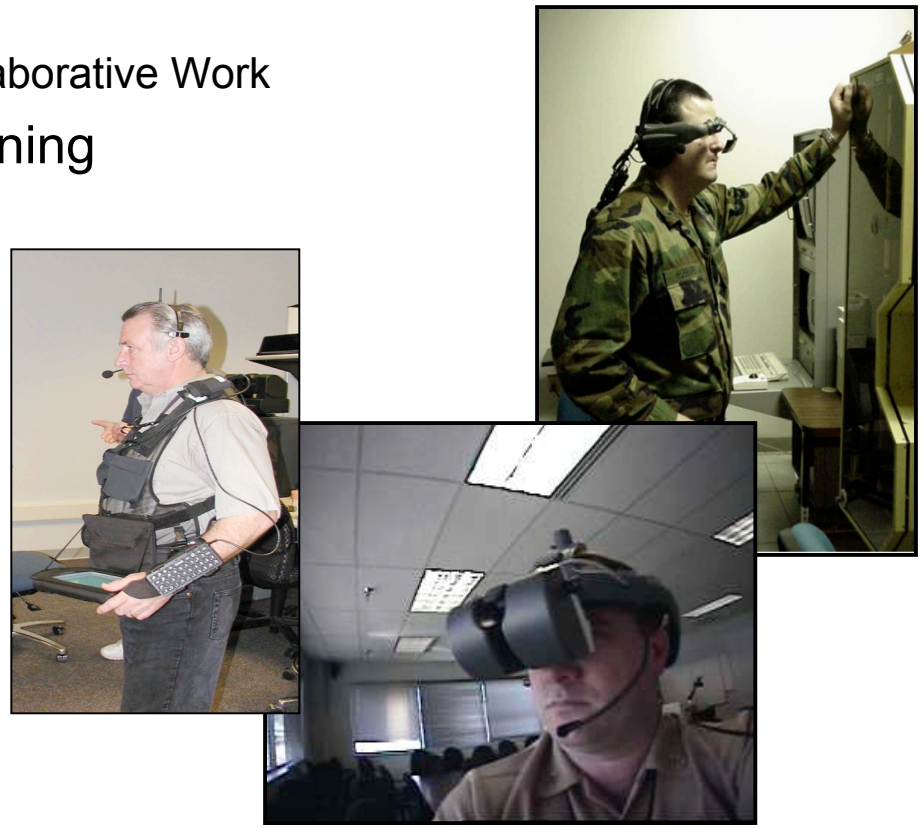
REMOTE TECHNICAL ASSISTANCE

Foundation for RTASS performance support tool

- Graduate work between NUWC Keyport and the Human Interface Technology Lab at the University of Washington
  - Design characteristics developed from human interface design research
    - Computer Supported Collaborative Work
- Effect of collaboration in learning

"The Effect of Reduced Bandwidth Video on Remote Collaboration Using Wearable Computers" – Lacey, Coyle, Billinghurst

"Remote Collaboration Using Wearable Computers: A Study and Experiment Design" - Lacey



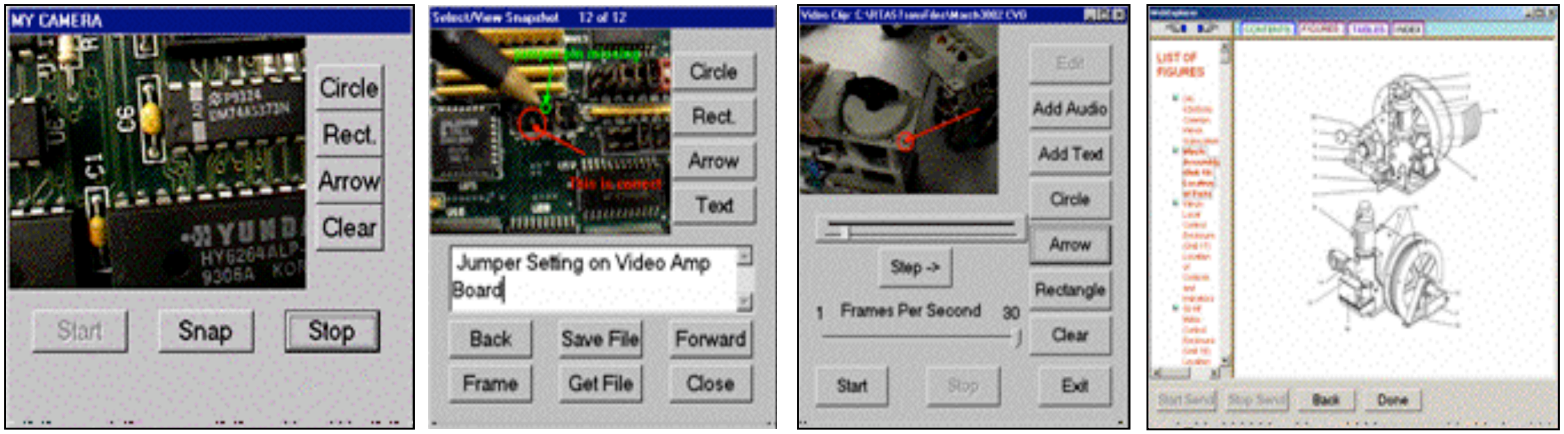
REMOTE TECHNICAL ASSISTANCE

Performance requirements focused on:

- Connecting the sailor with remote SME
- Share information and knowledge
- Collaborate in real time or near real time
- Ability for immediate feedback
- Task parameters
  - Physically constrained environment
  - Sailor mobility - hands-free operation
  - Easy access to electronic ship's force documents
  - Collaborative technical document browsing
  - Shared annotation of still images and documents
  - Capture and transmit still images from the sailor's location
  - Coalesce and transmit multi-sensor information

REMOTE TECHNICAL ASSISTANCE

- Primary design objective
  - Provide remote over the shoulder expert presence
- Design objective met by providing means for users to annotate with:
  - Live video and snapshots of the workspace
  - Make audio exchanges between users
  - Document collaboration
- Allows remote SMEs to see the worksite and literally point through the internet to items within the sailors worksite



REMOTE TECHNICAL ASSISTANCE

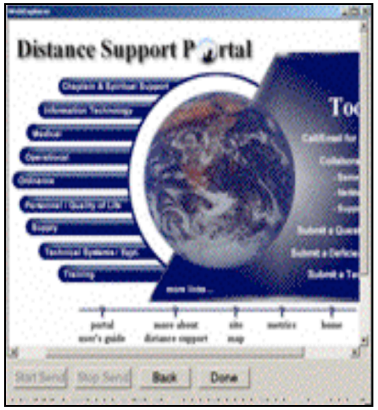
Description

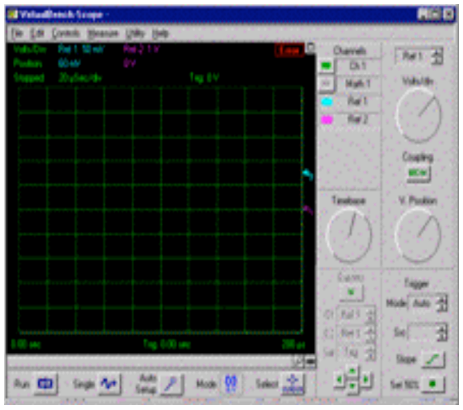
AN/PSM-99 RTASS is a distance maintenance tool that provides an Affordable, Low-Bandwidth, & Secure Video, Audio, Chat, Collaboration, & Over - the - Shoulder Expert Presence to every Warfighter.

RTASS uses many of the same capabilities found in collaboration tools but focuses on completing the maintenance task within the Navy's security and IT constraints.

Capabilities

- **Communications through NIPRNET & SIPRNET**
- **Live video and audio to interact with the expert for "over the shoulder" assistance**
- **Collaborate directly in real-time or near real-time**
- **"Point" using standard drawing conventions**
- **Collaborate with "Bench top" tools and HTML based information**
- **Escalate to RTASS when email and phone calls are not enough**



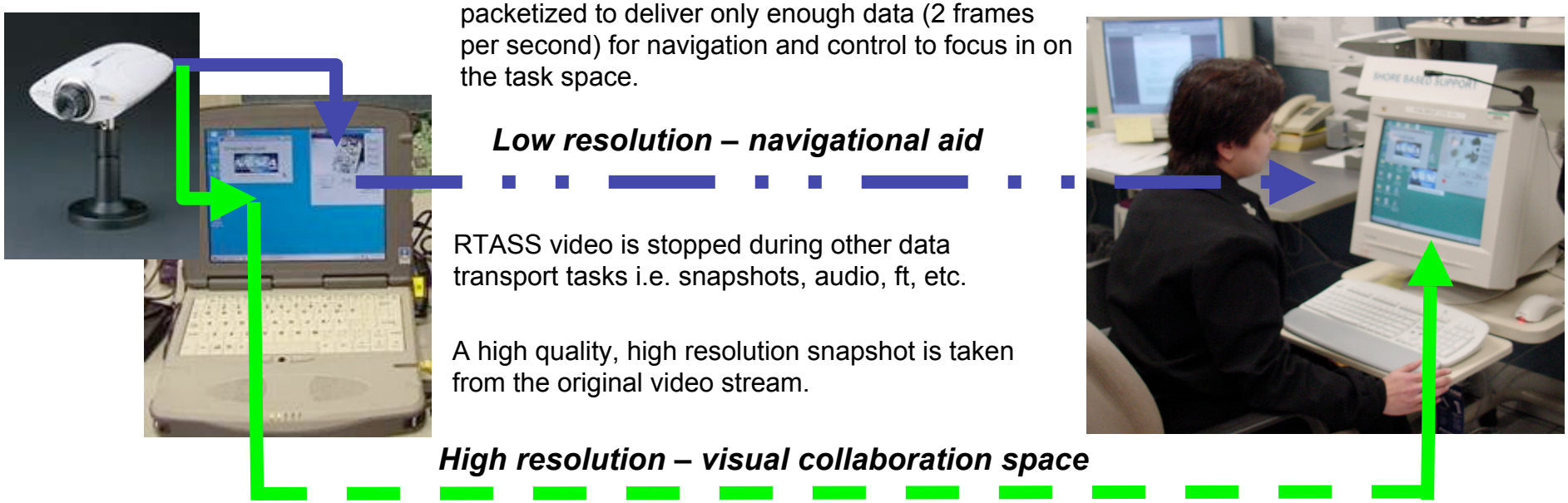


REMOTE TECHNICAL ASSISTANCE

High quality, high resolution video stream is input into RTASS.

RTASS VIDEO AND SNAPSHOT LOGIC

RTASS video is compressed, encrypted, and packetized to deliver only enough data (2 frames per second) for navigation and control to focus in on the task space.



Low resolution – navigational aid

RTASS video is stopped during other data transport tasks i.e. snapshots, audio, ft, etc.

A high quality, high resolution snapshot is taken from the original video stream.

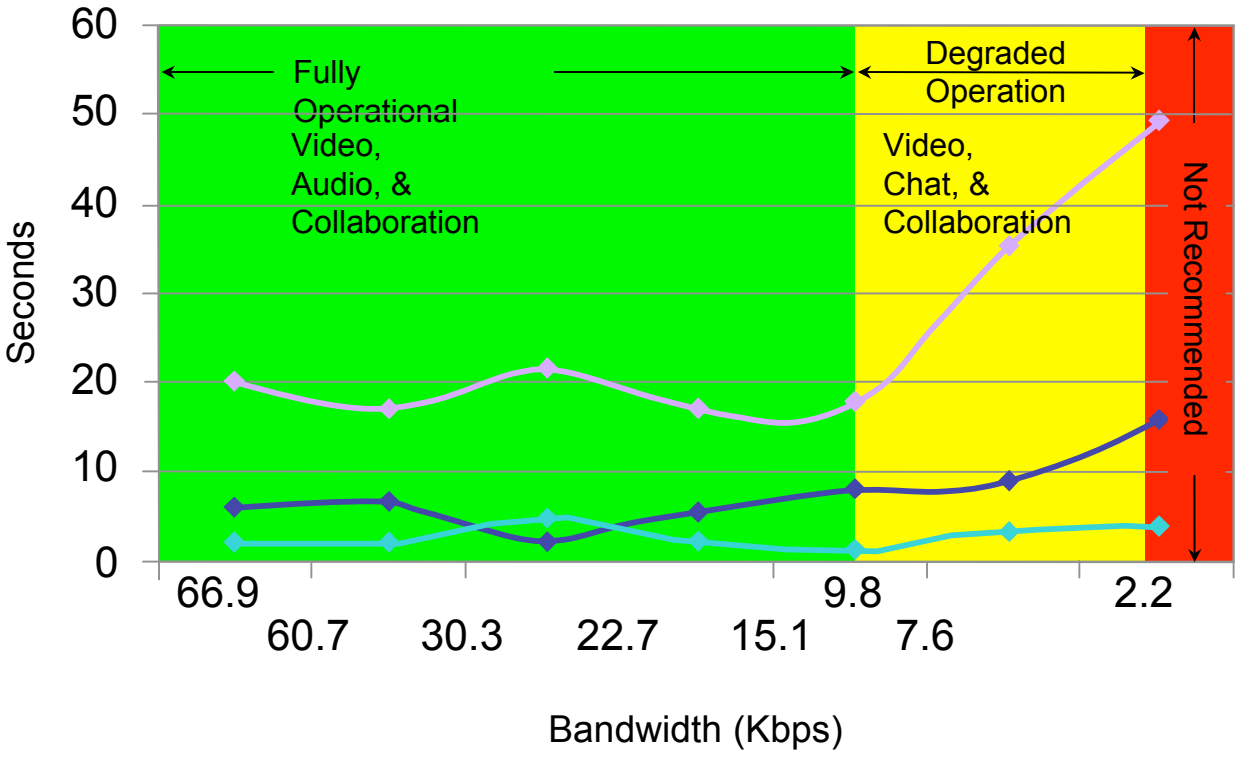
High resolution – visual collaboration space

The snapshot is compressed and encrypted on the remote computer and uncompressed and decrypted on the host providing a high quality, high resolution snapshot for collaboration.

RTASS video eliminates the iterative process involved with email; while the snapshots provide an interactive, collaborative space for detailed, inspection quality work!

REMOTE TECHNICAL ASSISTANCE

Working within the Navy's Bandwidth Constraints



Frame Delay (sec) @ d300 msec Delay

Audio Delay (sec) @ d300 msec Delay

Snapshot Transfer Time (sec) @ D300 msec Delay

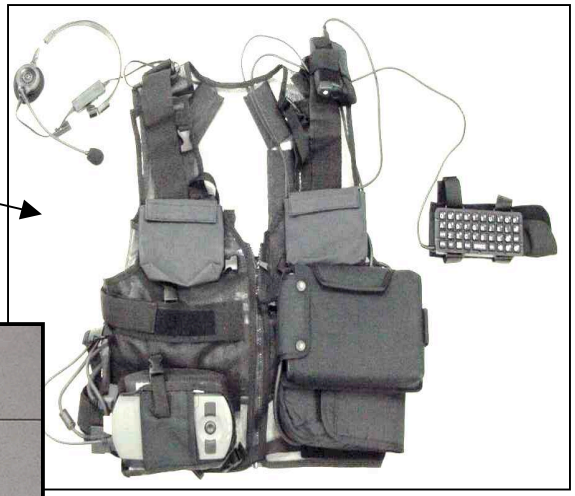
Based on Lab Testing Results of RTASS

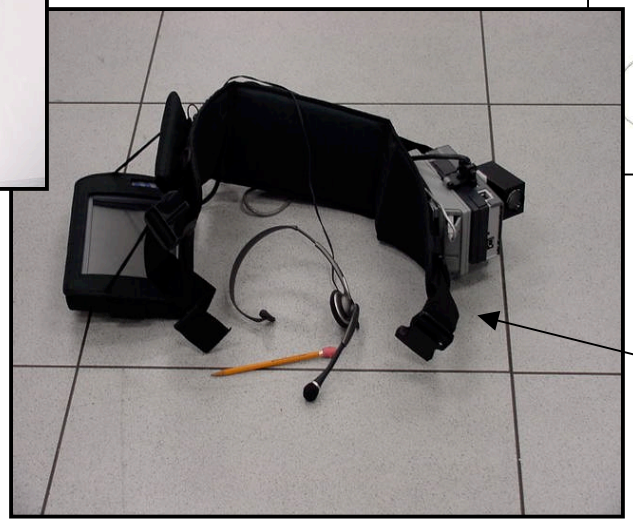
REMOTE TECHNICAL ASSISTANCE

Various Remote Technical Assistance Support System (RTASS) COTS hardware configurations

Ruggedized laptop model

Vest model





Wearable utility belt model

RTASS Software is NOT Hardware Dependent

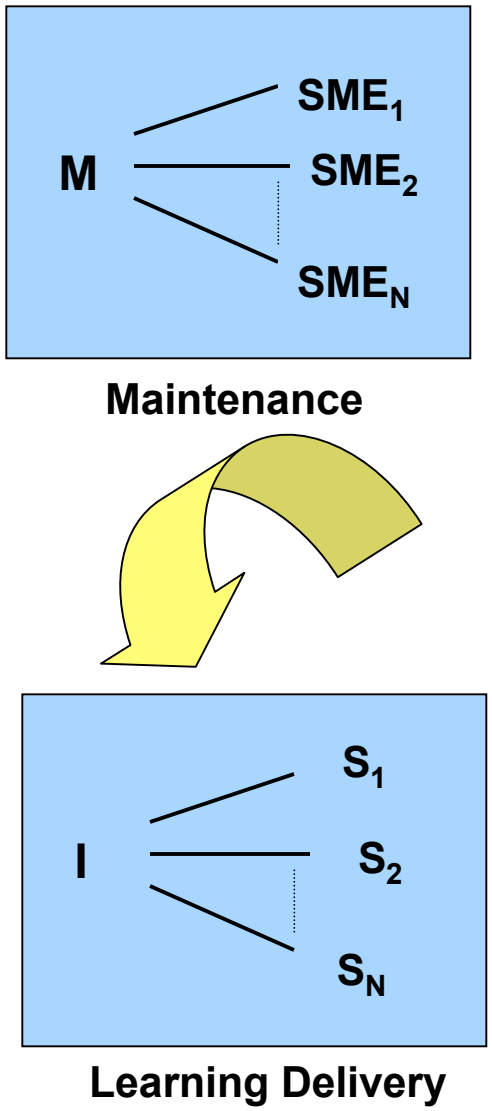
REMOTE TECHNICAL ASSISTANCE

- Recognized benefits
  - Communication over non-secure network
  - Operates in low bandwidth
  - Encryption
  - Reduced technical assistance response time
  - Reduced equipment downtime
  - Reduced travel costs
  - Enables Navy's optimal manning efforts
  - Mechanism for just-in-time training
  - Mechanism for performance based learning
- Planned Improvements
  - Wireless
  - Voice recognition
  - Stereo or 3D imaging
  - Virtual reality

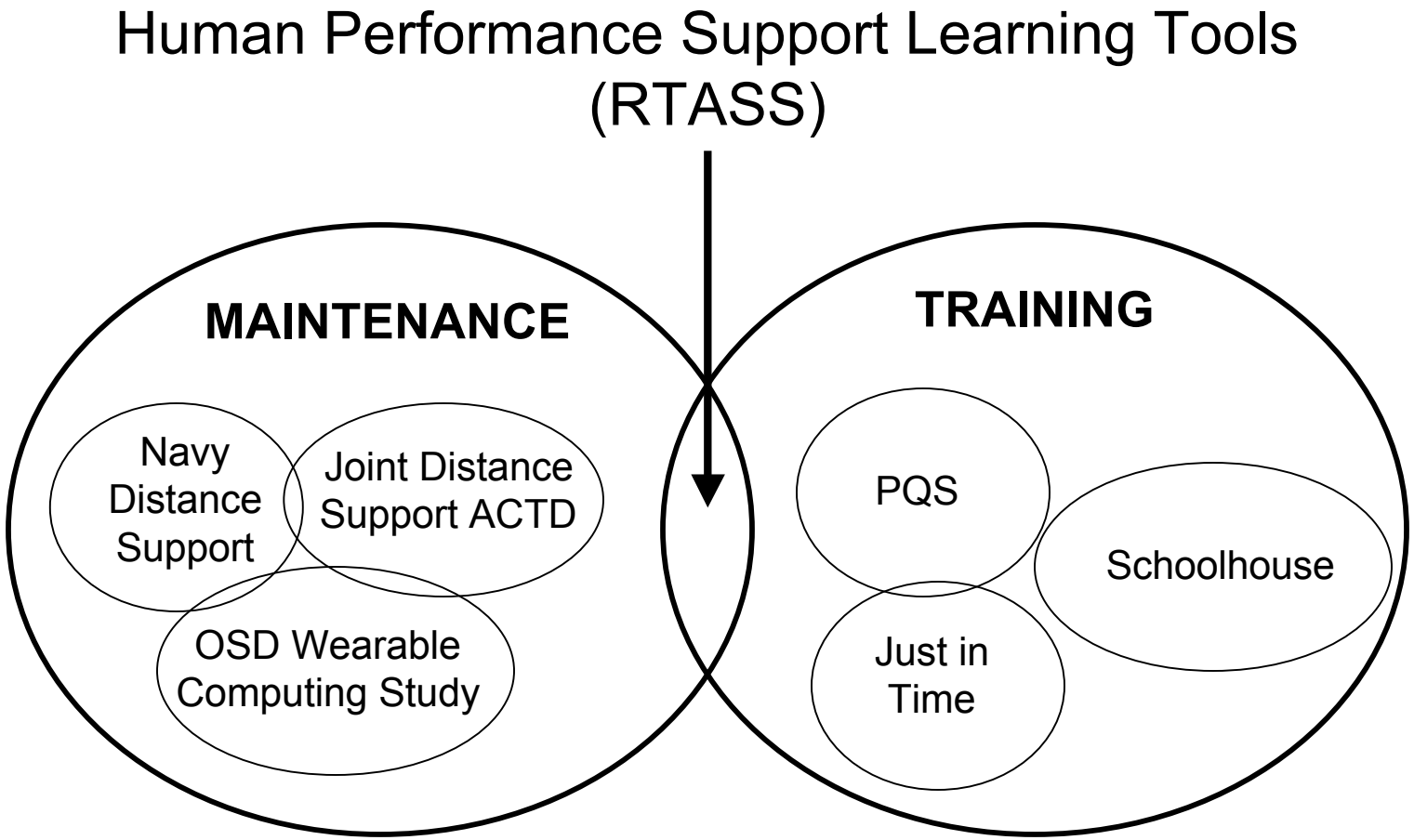
Enhancing Sea Warrior Performance

POTENTIAL USE IN A LEARNING ENVIRONMENT

- RTASS initially developed as a tool for maintenance
  - Learning was a by product of its use
- Potential to apply for more deliberate training or learning
  - Personal Qualifications System (PQS)
    - Ability to remotely verify sailor's ability to accomplish shipboard tasks
    - Facilitates real time interaction between the sailor and subject matter expert - remotely
  - Schoolhouse Use
    - Capitalize on inevitable lab bottleneck time
    - Connect sailor in schoolhouse with sailor shipboard in real world environment
    - Enabling the learning continuum

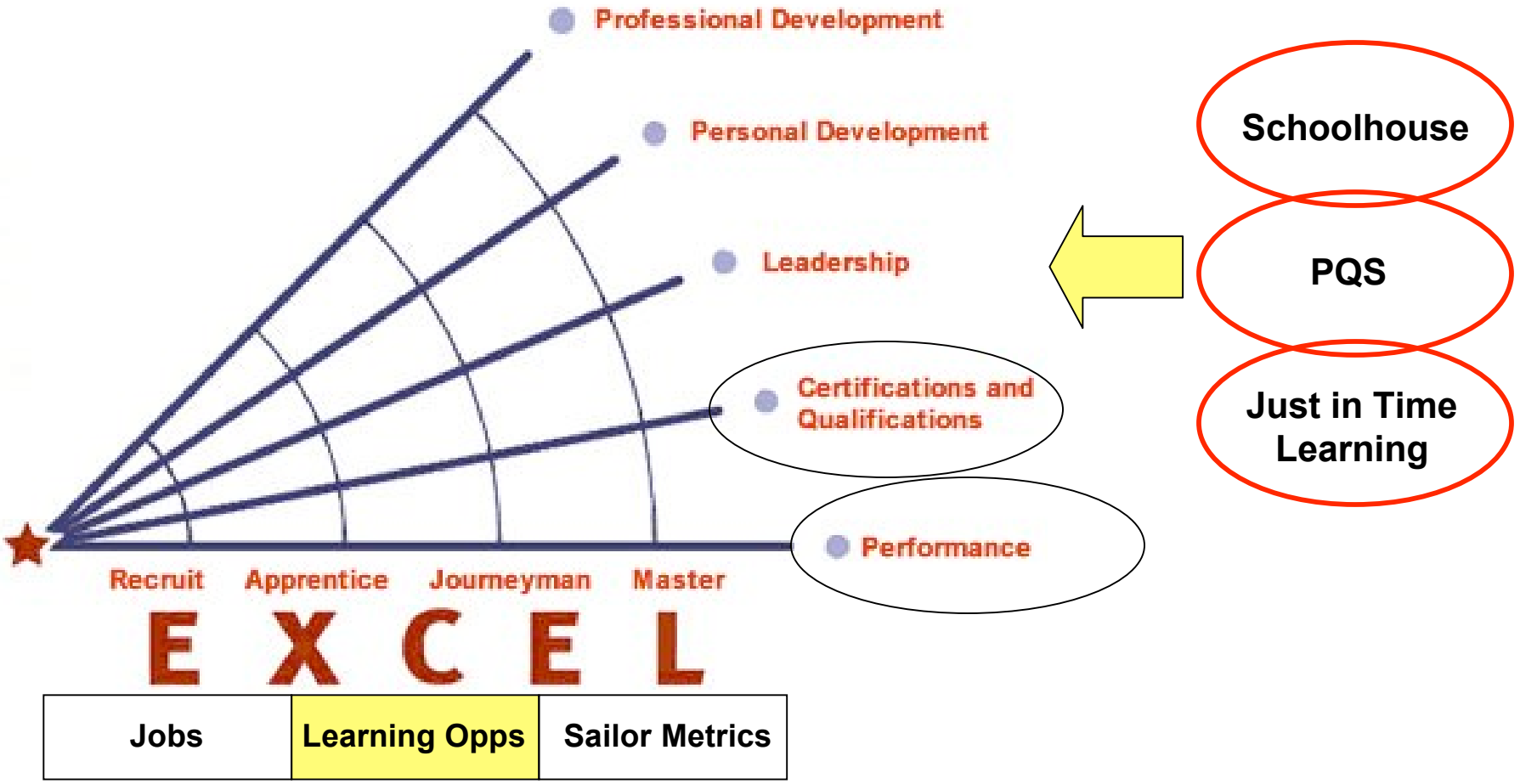


POTENTIAL USE IN A LEARNING ENVIRONMENT



Enhancing Sailor Job Performance by Capitalizing on Learning Opportunities Where Maintenance and Training Merge

POTENTIAL USE IN A LEARNING ENVIRONMENT



Advanced Learning Delivery through Remote Collaboration

CONCLUSION

"When the Navy is not fighting it is training. When the Navy is fighting it is training. The most important ingredient in the Navy's success is the talent, energy, dedication, skill, and courage of Sailors. Their growth and development must be the highest priority of Navy leaders."

Revolutionizing Navy Training by Exploiting Learning Opportunities through Remote Collaboration